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KNOWLEDGE AND INFORMATION AND COMMUNICATION TECHNOLOGIES: ITS EFFECT ON THE INNOVATION OF THE MEXICAN SMALL MEDIUM ENTERPRISES

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ABSTRACT*: The main purpose of the study is to analyze the relationship between knowledge and technological management and innovation practices in Small and Medium Enterprises (SMEs). The 412 companies that participate in the study are located in the Northwest region of Mexico and have 10 to 250 employees. The data collection was through a structured survey aimed at the managers of each SME. The field work was carried out during the months of May to November of the year 2017. For the analysis of the data and the verification of the hypotheses the Structural Equation Model (SEM) based on the variance was used through the Partial Least Square (PLS). The findings corroborate that the knowledge that exists within companies, is crucial to improve technology management and to increase innovation practices that are developed in the SME. In addition, we find that the Technological Management is contributing significantly in the consecution of greater practices of Innovation. Our study contributes to the development of the theory based on resources and capabilities (RBV).*

KEYWORDS: knowledge, internal knowledge, external knowledge, technological management, innovation, small and medium enterprises (SMES).

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INTRODUCTION

In these times when markets and highly competitive environments exist, knowledge and information and communication technologies (ICT) have become a business strategy that is in great demand by most organizations (Cohen & Olsen, 2015; Nonaka, 2007). These two strategies can lead organizations to conquer new markets, raise productivity and also produce changes in innovation practices. All these manifestations are products of the resources and capabilities with which a company owns and deploys in all its organizational structure (Barney, Ketchen, & Wright, 2011). Some experts in the field have expressed that the theory based on resources and capacities (RBV), has been one of the trends that have managed to analyze in greater depth the effects of knowledge, technology management and innovation in the company (Barney, 1991; Teece, 2009). More often, companies are equipping their employees with skills and competencies, in order to improve their skills, improve productivity and increase innovation capacity. At the same time, with technological development, the knowledge a company has is gathered from inside and outside (Davenport & Prusak, 1998; Tong, Tak, & Wong, 2015). This knowledge becomes more and more important for the company because of the intangible value it represents (Nonaka & Toyama, 2003; Takeuchi, 2013). When companies manage to manage their knowledge and apply it correctly, the results can be more creative, they can improve innovation practices and without a doubt, business profitability increases. However, despite all these benefits that these capacities can generate, this is manifested with greater presence in large organizations and little in small and medium enterprises (SMEs) (Darroch, 2005; Teece, 2010; Valdez-Juárez, De Lema, & Maldonado-Guzmán, 2016). In addition, this type of companies to be able to adopt and deploy these strategies, have to face a series of limitations and barriers, which prevents them from being more competitive (Bax, Elvik, & Veisten, 2009; Thomä, 2017). Some of them are: 1) poor strategic vision of managers, 2) resistance to change (employees and managers), 3) lack of interest in innovation 4) lack of interest in investment in research and development of new products, 5) shortage of economic and financial resources, and 6) obsolete technology (Riege, 2005; Zhu, Wittmann, & Peng, 2012). Our article analyzes these strategies in a region with social and economic problems, which is cataloged as an area that is in the process of development. Therefore, research has an important theoretical and empirical contribution. First, the study analyzes the resources (internal and external knowledge) and capacities (technology and innovation), as the

most important intangible assets to achieve the competitiveness and organizational development of SMEs. Second, the proposed theoretical model is a combination of the traditional knowledge model and a new technology-focused approach for creative and innovative companies (SMEs).

Our main purpose is to discover the effect of knowledge on technological management and innovation practices in SMEs. In addition, we analyze the effect of technological management on innovation practices that are developed in the SME. The document is structured as follows: in the first phase the review of the literature and the hypotheses is shown, then the methodology, the results and the main conclusions.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Knowledge, its relationship with technology and innovation in the SMEs

Knowledge has been analyzed theoretically and empirically since ancient times because of the value it represents for the development of societies and without doubt, for companies. Knowledge is the process by which individuals and groups learn to develop their ideas in value products (Nonaka, and Takeuchi, 1995; Zahra & George, 2002). Knowledge is learned in an explicit and explicit way. In addition, knowledge can be obtained within the same company, but also outside the organization, this helps the company to be more innovative (Davenport, and Prusak, 2000; Nonaka, 2007). All this is based on the theory based on resources and capabilities. Recently, knowledge has been increasing and improving over the years, this is due to the technological changes that occur in most of the regions. Some authors on the subject have expressed that companies that are based on individual and organizational knowledge, substantially improve the administration of technology (Earl, 2001; Gray, 2006). In addition, the more training and (technological) training the employees of a company have, the productivity is improved, the automation of the processes and the usefulness of the new technological tools is improved such as: social networks, video conferencing systems, and other current communication systems, etc. This shows that knowledge has a close relationship with the technological management of an organization (Bourke & Crowley, 2015; García-Sánchez, García-Morales, & Bolívar-Ramos,

2015). In the same way, a great current of researchers has corroborated that the companies that correctly manage the knowledge, allow them to increase the creativity and innovation capacity of the employees. Innovation manifests itself when workers in an organization manage to make small but significant changes in products, processes and organizational management (Müller, Buliga, & Voigt, 2018; Tong et al., 2015). Action that leads the company to other dimensions and capabilities. Recent studies have shown that a greater learning and knowledge of individuals of companies, helps to improve the design of their products, develop patents, improve production systems and establish greater relationships with their customers (Mourtzis, Boli, Dimitrakopoulos, Zygomalas, & Koutoupes, 2018; Nguyen & Pham, 2017). With this, it becomes clear that knowledge and innovation practices are closely interrelated. From the previous context the following hypotheses have been developed:

H1. The more Knowledge, the Technological Management of the SME increases.
H2. The more Knowledge, the Innovation Practices in the SME are improved.

Technological Management and Innovation in the SMEs

Technology in recent and current times, represents for companies one of the most important and decisive strategies to achieve competitiveness. This cannot be achieved without proper knowledge management. Some authors, such as Davenport (2016), have shown that the Management of Technology is a crucial element for the success of current organizations and that they want to be competitive in terms of innovation. However, the deployment of new technologies requires investment, time and training. In this same direction, some authors have expressed that new technologies are changing the ways of working, processes and ways of doing business (Loon & Chik, 2019; Soto-Acosta, Popa, & Martinez-Conesa, 2018). With this, technological innovation has arisen, which has as main purpose, to improve the internal processes of the company, to improve the designs of the products, to arrive more quickly and efficiently towards the new markets and towards the clients. What innovative technology-based companies seek is to discover new markets and offer radical products (superior value) to their current and potential consumers (Gërguri-Rashiti, Ramadani, Abazi-Alili, Dana, & Ratten, 2017; Loon & Chik, 2019; Rodríguez, Nieto, & Santamaría, 2018). With the above, it is possible to argue that when there is

a good Technological Management it is possible to improve innovation practices in the field of SMEs. From the previous context the following hypothesis has been developed:

H3. A greater Technological Management causes that the Practices of Innovation in the SME are increased.

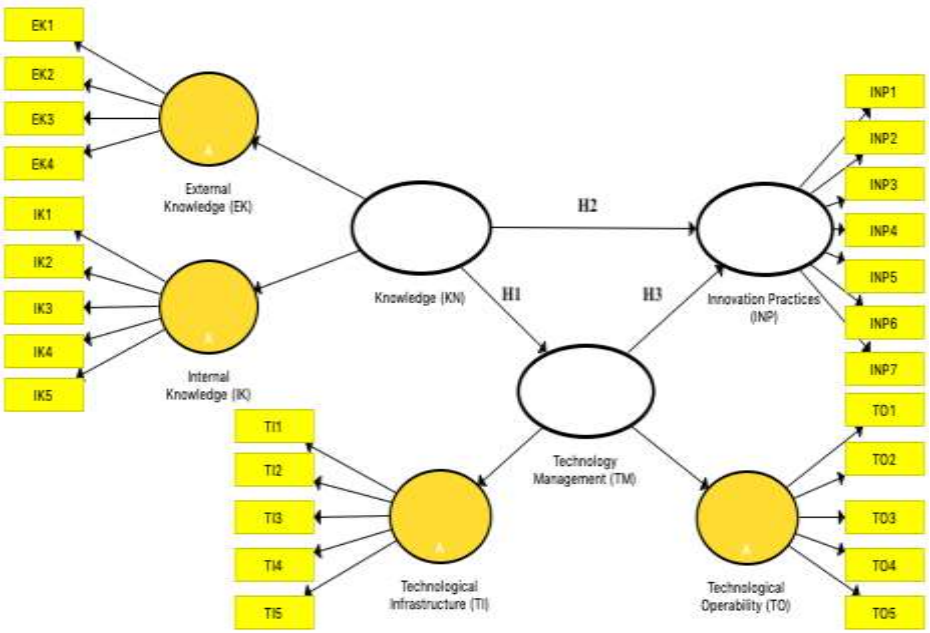

Figure 1. Theoretical model

METHODOLOGY

The study is quantitative and predictive. The selection of companies has been structured by activity sector. The information of the population (companies) was compiled through the database provided by the National Institute of Geography and Information Technology (INEGI, 2018). The sample groups companies from the industrial sector of the Northwest region of Mexico. The smallest company has 10 employees and the largest with 250 employees. At first, a pilot test was applied to 10% of the sample in order to validate the instrument (survey). For the data collection a structured

survey was applied to the manager of the SME. The field work was carried out during the month of May until the month of November of the year 2017. The sample size was determined to achieve the maximum margin of error for the estimation of a proportion (relative frequency of response in a specific item of a question) was lower than 0.03 points with a confidence level of 95%. Finally, a sample of 412 companies was obtained. The organizations that participate in the research have the following characteristics: 74% are small companies with 10 to 50 employees and the other 26% are medium-sized companies with 51 to 250 employees. These companies are managed by 81% of male managers and by 19% of female managers. In addition, these managers are within these age ranges: 1) 80% have 31 to 50 years old, 2) 11% are between 20 and 30 years old, and 9% of managers have more than 50 years old.

Variables

In order to correctly analyze the variables structured in the study and by the nature of the constructs of this research, a model with first and second order reflective variables has been developed. The reflective variables are mainly characterized by the fact that the direction of the effect and the influence go from the construct to the indicator. In addition, these variables are characterized by the fact that all the indicators of a construct are highly correlated (co-vary); they are interchangeable, and, if an indicator is eliminated, it does not alter the meaning and content of the construct (Wetzels, Odekerken-Schröder, & van Oppen, 2009). For the evaluation of the second-order multidimensional construct (KN and TM), the two-step approach was used through the construction of latent variables (Schuberth, Henseler, & Dijkstra, 2018). The first step is to estimate the scores of the first order dimensions, and in the second step the results of these scores are used to model the second order construct (Van Riel, Henseler, Kemény, & Sasovova, 2017).

Knowledge (KN). This variable was measured according to the theoretical and empirical studies that exist in the literature on knowledge and its relation to innovation. In order to analyze in a more exhaustive way this variable has been measured as a factor of second order (reflective type) and reference has been made to the studies developed by: (Nonaka and Takeuchi, 1995; Zahra & George, 2002), which is structured by Internal Knowledge (4 questions) and External Knowledge (5 questions). The

questionnaire was addressed to the manager of each SME to answer these questions. The questions were elaborated with a Likert scale of 5 points. 1 = Completely disagree to 5 = Strongly agree (see Table 1).

Technology Management (TM). This variable was measured according to the theoretical and empirical studies that exist in the literature on technological development and its relation to knowledge. In order to analyze in a more exhaustive way this variable has been measured as a factor of second order (reflective type) and has been taken as reference the studies developed by: (Davenport and Prusak, 2000; Davenport, 2016; Neirotti, Raguseo, & Paolucci, 2018), which is structured by the Technological Infrastructure (5 questions) and Technological Operability (5 questions). The questionnaire was addressed to the manager of each SME to answer these questions. The questions were elaborated with a Likert scale of 5 points. 1 = Completely disagree to 5 = Strongly agree (see Table 1).

Innovation Practices (INP). This variable was measured according to the theoretical and empirical studies that exist in the literature on innovative capacity and its relation to knowledge. This variable has been measured as a first order factor (reflective type) and the studies developed by: (OECD, 2005; Teece, 2010) have been taken as reference. The questionnaire was addressed to the manager of each SME to answer these questions. This variable contains 7 questions and was elaborated with a Likert scale of 5 points. 1 = Completely disagree to 5 = Strongly agree (see Table 1).

Table 1. Internal consistency and convergent validity by construct

	Variable	FL	CR	CA
KN	Knowledge		0.879	0.845
	Internal Knowledge (IK), comes from:		0.875	0.822
IK1	the workers themselves	0.752***		
IK2	the internal training	0.780***		
IK3	the organization's manuals	0.762***		
IK4	the electronic repositories of the company	0.739***		
IK5	the experience of the leaders of the company	0.786***		
	External Knowledge (EK), comes from:		0.896	0.845

EK1	other organizations in the sector	0.814***		
EK2	the company's suppliers	0.881***		
EK3	the customers of the company	0.782***		
EK4	the research centers and universities	0.827***		
	Technology Management (TM)		0.905	0.884
	Technological Infrastructure (TI), The company:		0.877	0.825
TI1	Optimize the use of ICT	0.754***		
TI2	It has electronic tools: e-mail, skype, WhatsApp	0.774***		
TI3	It has a formal department of ICT	0.777***		
TI4	Invests in the adoption of new ICT	0.782***		
TI5	Optimize the use of ICT	0.750***		
	Technological Operability (TO), The Company uses:		0.878	0.826
TO1	Computerized systems for the control of information	0.826***		
TO2	Computer systems to analyze the market	0.771***		
TO3	Computer systems to solve operational problems	0.751***		
TO4	The ICT, for management and operational tasks	0.734***		
TO5	The ICT, for the deployment of marketing strategies	0.757***		
	Innovation Practices (INP), in the last two years the company has made:		0.946	0.936
INP1	Improvements in the design of products and/or services	0.855***		
INP2	Improvements in marketing	0.870***		
INP3	Changes and/or improvements in the processes	0.882***		
INP3	Significant changes in the direction and management of the company	0.806***		
INP4	Automation in the process of purchases and inventories	0.802***		
INP5	Improvement in employee creativity	0.847***		
INP6	Improvement in customer relations (CRM)	0.852***		

*Note: FL= Factor load, CR= Composite Reliability, AC= Cronbach's Alpha, *: p < 0.1, **: p < 0.05, ***: p < 0.01.*

RESULTS

Measurement model

To evaluate the measurement model with reflective type variables in A mode, the composite reliability of each item, the internal consistency of the scale, and the convergent validity are analyzed. To measure the relationship and the individual reliability of each item, a standardized load on the factor greater than 0.707 is recommended (Chin & Dibbern, 2010). The composite reliability must be above 0.800 recommended by Nunnally (1978) and Vandenberg & Lance (2000a). Cronbach's alpha is considered satisfactory over 0.700 (Vandenberg & Lance, 2000b). In our model, all these indicators show a behavior above what was proposed by the experts in the subject (see Table 1). The average variance extracted (AVE) indicates the average amount of the variance explained by the indicators of the construct. These results are above the threshold of 0.500, as proposed by Hair, Jr., Marko Sarstedt & Ringle (2017). Finally, the discriminant validity of the constructions in the model was verified by analyzing the square root of the AVE. The (diagonal) results of the vertical and horizontal AVE are below the correlation between the constructs (Henseler, Ringle, & Sarstedt, 2015). This test detects no anomaly (see Table 2). Our results provide adequate validity and reliability (convergent and discriminant).

Table 2. Discriminant validity of the theoretical model

Variable	AVE	INP	KN	TM
INP	0.715	**0.846**		
KN	0.498	0.769	**0.669**	
TM	0.501	0.627	0.626	**0.700**

Note: INP= (Innovation Practices), KN (Knowledge), TM (Technology Management).

Structural model

Table 3 shows the results of the hypotheses. All relationships structured in the theoretical model have empirical support, that is, they all have a positive and significant effect at 99%. Firstly, it is observed that Knowledge strongly influences the Technology Management and Innovation Practices that the SME develops, according to the beta values of 0.626 *** and 0.620 ***. In addition, we observe that the Technological Management directly influences the results of the Innovation Practices that are developed in the SME, according to the beta result of 0.239 ***.

To evaluate the fit of the model, the Structural Equation Model (SEM) techniques are based on the covariance; in Partial Least Square (PLS), it is not possible to estimate these measurements. However, PLS analyzes the value of the trajectory coefficients, the analysis of R^2, and the values of F^2; these are significant individual measures to explain the predictive capacity of the structural model (Chin & Dibbern, 2010). The statistical test Q^2 (cross-validated redundancy index) is used to evaluate and test the predictive relevance of endogenous constructs in a structured model with reflective variables. The model was evaluated through the blindfolding technique (Sarstedt, Ringle, & Hair, 2017). Values greater than 0 show a remarkable predictive quality (Hair, Jr., Marko Sarstedt & Ringle, 2017); the data can be observed in Table 3 and 4. To explain the predictive effect of our model more accurately, we have added a goodness-of-fit test performed by PLS. Thus, we have used the standardized indicator of the residual quadratic mean (SRMR); when this value is in a range of (<0.08-0.1), there is an acceptable adjustment (see Table 4)(Hair, 2016)

Table 3. Results of the hypothesis test

Hypothesis	Beta Value	T Score	P Valor	F^2	Q^2
H1. KN -> TM	0.626***	16.315	0.000	0.643	0.424
H2. KN -> INP	0.620***	13.317	0.000	0.626	0.415
H3. TM -> INP	0.239***	3.709	0.000	0.093	0.178

*Note: *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.*

Table 4. Predictive quality and fit of the model

Variables	R^2	SRMR=0.100
Innovation Practices	0.625	
Technology Management	0.390	

CONCLUSION

In the context of the theory of resources and capabilities, in this section we analyze and discuss the findings of this research. From the theoretical and empirical point of view, our results corroborate that the Knowledge in combination Technological Management contribute in the development of the Capabilities and Practices of Innovation in the SMEs.

In a first analysis, it has been corroborated that the results with greater weight and more strength in the proposed model, is between the relationship that Knowledge has with Technological Management and with Innovation Practices. These results are in the same direction as the empirical studies and the literature reviewed, with this it is concluded that Knowledge is a crucial strategy to raise the competitiveness of SMEs (Newey & Zahra, 2009; Søilen & Tontini, 2013; Takeuchi', 2013). Secondly, with a strong impact, we find that Technological Management has a significant impact on Innovation Practices, with this, we verify that when there is a correct connection between Knowledge and Technological Management, we can achieve results of greater magnitude and of greater scope. These findings are aligned with the theory and with the main empirical studies that were analyzed in this study (Davenport, 1999; Davenport, 2016; Neirotti et al., 2018). The following implications have been derived from the foregoing: 1) managers should continue with training in new technologies and the use of virtual knowledge (Larsen & Olaisen, 2013; Tong et al., 2015), 2) owners and managers of SMEs, they are recommended to expand their vision towards the implementation of new business models focused on creativity and technological innovation (Teece, 2010; Tucci, Chesbrough, Piller, & West, 2016), and 3) the owners and managers of SMEs, should seek strategic alliances to seek investment in technology and in Research and Development (R&D) (Chesbrough, 2006; Thomä, 2017).

The research exhibits some limitations, but at the same time opens a window of possibilities for future lines of research. Among the main limitations presented by the study are: 1) the information collected through the interviews with the managers of SMEs, were subjective opinions of each of them, this could have some bias in the information. For this, it is recommended for future studies, analyze the opinion of workers and customers of these companies in order to contrast the results. 2) The sample can be raised and applied in other regions of Mexico, or even in regions of other countries, in order to develop cross-cultural studies. 3) The statistical analysis is based on the analysis of the variance; in the future we can use other statistical analyzes that focus on the analysis of the covariance.

In order to continue with the analysis of the development and growth of SMEs, it is convenient to study in the future these same variables (Knowledge, Technology and Innovation) and add new constructs to the theoretical model with current trends such as: virtual knowledge, innovation technology, open innovation and the circular economy.

References

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17(1)*, 99–120.

Barney, J. B., Ketchen, D. J., & Wright, M. (2011). The future of resource-based theory: Revitalization or decline? *Journal of Management*, *37*(5), 1299–1315. https://doi.org/10.1177/0149206310391805

Bax, C., Elvik, R., & Veisten, K. (2009). Knowledge Utilisation in Road Safety Policy: Barriers to the Use of Knowledge from Economic Analysis. *Knowledge, Technology & Policy*, *22*(4), 275–285. https://doi.org/10.1007/s12130-009-9088-6

Bourke, J., & Crowley, F. (2015). The Role Of Hrm And Ict Complementarities In Firm Innovation: Evidence From Transition Economies. *International Journal of Innovation Management*, *19*(05), 1550054. https://doi.org/10.1142/S1363919615500541

Chesbrough, H. W. (2006). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press. Retrieved from https://books.google.com.mx/books?id=OeLIH89YiMcC

Chin, W. W., & Dibbern, J. (2010). *Handbook of Partial Least Squares*. *Handbook of Partial Least Squares*. https://doi.org/10.1007/978-3-540-32827-8

Cohen, J. F., & Olsen, K. (2015). Knowledge management capabilities and

firm performance: A test of universalistic, contingency and complementarity perspectives. *Expert Systems with Applications*, *42*(3), 1178–1188. https://doi.org/10.1016/j.eswa.2014.09.002

Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, *9*(3), 101–115. https://doi.org/10.1108/13673270510602809

Davenport, T. H., and Prusak, L. (2000). *Working Knowledge: How Organizations Manage What They Know*. (H. B. S. P. Books, Ed.). United States of America.

Davenport, T. (1999). Knowledge management and the broader firm: strategy, advantage, and performance. *Knowledge Management Handbook*, 1–11. Retrieved from http://pessoal.utfpr.edu.br/sato/arquivos/strategy_km_davenport_v2.pdf

Davenport, T. H. (2016). Personal Knowledge Management and Knowledge Worker Capabilities, 189–210. https://doi.org/10.4324/9781315600154-15

Davenport, T. H., & Prusak, L. (1998). *Working knowledge : how organizations manage what they know*. Harvard Business School Press.

Earl, M. J. (2001). Knowledge Management Strategies: Toward a Taxonomy. *Journal of Management Information Systems*. https://doi.org/10.1080/07421222.2001.11045670

García-Sánchez, E., García-Morales, V. J., & Bolívar-Ramos, M. T. (2015). The influence of top management support for ICTs on organisational performance through knowledge acquisition, transfer, and utilisation. *Review of Managerial Science*. https://doi.org/10.1007/s11846-015-0179-3

Gërguri-Rashiti, S., Ramadani, V., Abazi-Alili, H., Dana, L. P., & Ratten, V. (2017). ICT, Innovation and Firm Performance: The Transition Economies Context. *Thunderbird International Business Review*, *59*(1), 93–102. https://doi.org/10.1002/tie.21772

Gray, C. (2006). Absorptive capacity, knowledge management and innovation in entrepreneurial small firms, *12*(6), 345–360. https://doi.org/10.1108/13552550610710144

Hair, J. F. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Retrieved from https://books.google.es/books?id=Xn-LCwAAQBAJ&dq=SEM+VARIABLES+HENSELER+2017&lr=&hl=es&source=gbs_navlinks_s

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

INEGI. (2018). *Instituto Nacional de Estadística y Geografía. Empleo y ocupación*. *Encuestas en hogares. Regulares. Encuesta Nacional de Ocupación y Empleo. ENOE, población de 15 años y más de edad*. Instituto Nacional de Estadística y Geografía. INEGI. Retrieved from https://www.inegi.org.mx/temas/empleo/

Joseph F. Hair, Jr., Marko Sarstedt & Christian M. Ringle, S. P. G. (2017). *Advanced Issues in Partial Least Squares Structural Equation Modeling*. (SAGE, Ed.) (SAGE). Retrieved from https://books.google.com.mx/books?hl=es&lr=&id=-f1rDgAAQBAJ&oi=fnd&pg=PP1&dq=Hair+et+al+2016+VIF,+multicollinearity+PLS&ots=vX_5koFV9Z&sig=vtagongb9FZRoAU49ZEochmq8AY#v=onepage&q&f=false

Larsen, T. J., & Olaisen, J. (2013). Innovating strategically in information and knowledge management: Applications of organizational behavior theory. *International Journal of Information Management*, *33*(5), 764–774. https://doi.org/10.1016/j.ijinfomgt.2013.05.003

Loon, M., & Chik, R. (2019). Efficiency-centered, innovation-enabling business models of high tech SMEs: Evidence from Hong Kong. *Asia Pacific Journal of Management*, *36*(1), 87–111. https://doi.org/10.1007/s10490-017-9558-4

Mourtzis, D., Boli, N., Dimitrakopoulos, G., Zygomalas, S., & Koutoupes, A. (2018). Enabling Small Medium Enterprises (SMEs) to improve their potential through the Teaching Factory paradigm. *Procedia Manufacturing*, *23*, 183–188. https://doi.org/10.1016/J.PROMFG.2018.04.014

Müller, J. M., Buliga, O., & Voigt, K.-I. (2018). Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0. *Technological Forecasting and Social Change*, *132*, 2–17. https://doi.org/10.1016/J.TECHFORE.2017.12.019

Neirotti, P., Raguseo, E., & Paolucci, E. (2018). How SMEs develop ICT-based capabilities in response to their environment. *Journal of Enterprise Information Management*, *31*(1), 10–37. https://doi.org/10.1108/JEIM-09-2016-0158

Newey, L. R., & Zahra, S. A. (2009). The Evolving Firm: How Dynamic and Operating Capabilities Interact to Enable Entrepreneurship. *British Journal of Management*, *20*(s1), S81–S100.

https://doi.org/10.1111/j.1467-8551.2008.00614.x

Nguyen, V. T., & Pham, T. A. (2017). Knowledge Management Strategies, Imitation, and Innovation. In *Organizational Learning in Asia* (pp. 85–108). Elsevier. https://doi.org/10.1016/B978-0-08-100983-3.00004-6

Nonaka, I. and Takeuchi, H. (1995). *The Knowledge –creation Company*. (Oxford University Press, Ed.). New York, NY.

Nonaka, I. (2007). The knowledge-creating company. *Harvard Business Review*, *85*(7–8). https://doi.org/10.1016/0024-6301(96)81509-3

Nonaka, I., & Toyama, R. (2003). The knowledge-creating theory revisited: knowledge creation as a synthesizing process. *Knowledge Management Research & Practice*, *1*(1), 2–10. https://doi.org/10.1057/palgrave.kmrp.8500001

Nunnally, J. (1978). *Psychometric Methods. New York: McGraw-Hill*. New york: McGraw-Hill.

OECD. (2005). *Organisation for Economic Co-operation and Development. Statistical Office of the European Communities. Oslo manual : guidelines for collecting and interpreting technological innovation data.* Organisation for Economic Co-operation and Development. Retrieved from https://books.google.es/books?id=P12qjEXYHfUC&dq=OECD,+OSLO+INNOVATION+2005&hl=es&source=gbs_navlinks_s

Riege, A. (2005). Three-dozen knowledge-sharing barriers managers must consider. *Journal of Knowledge Management*, *9*(3), 18–35. https://doi.org/10.1108/13673270510602746

Roberts, P., Priest, H., (through, M. T.-N. S., & 2006, U. (2006). Reliability and validity in research. *Search.Proquest.Com*, *20*, *n*, 41. Retrieved from http://search.proquest.com/openview/3d4a3288ee02e614e09ec585c63ed52d/1?pq-origsite=gscholar&cbl=30130

Rodríguez, A., Nieto, M. J., & Santamaría, L. (2018). International collaboration and innovation in professional and technological knowledge-intensive services. *Industry and Innovation*, *25*(4), 408–431. https://doi.org/10.1080/13662716.2017.1414752

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial Least Squares Structural Equation Modeling. In *Handbook of Market Research* (pp. 1–40). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-05542-8_15-1

Schuberth, F., Henseler, J., & Dijkstra, T. K. (2018). Partial least squares path modeling using ordinal categorical indicators. *Quality &*

Quantity, *52*(1), 9–35. https://doi.org/10.1007/s11135-016-0401-7

Søilen, K. S., & Tontini, G. (2013). Knowledge Management Systems and Human Resource Management Policies for Innovation Benchmarking : a Study of ST Ericsson. *International Journal of Innovation Science*, *5*(3), 159–171. https://doi.org/10.1260/1757-2223.5.3.159

Soto-Acosta, P., Popa, S., & Martinez-Conesa, I. (2018). Information technology, knowledge management and environmental dynamism as drivers of innovation ambidexterity: a study in SMEs. *Journal of Knowledge Management*, *22*(4), 824–849. https://doi.org/10.1108/JKM-10-2017-0448

Takeuchi', H. (2013). Knowledge-Based View of Strategy. *Universia Business Review*, *Cuarto Tri*(40), 68–79.

Teece, D. J. (2009). *Dynamic capabilities and strategic management: organizing for innovation and growth*. (O. University, Ed.), *Essays in Technology Management and Policy - Selected Papers of David J. Teece*. New york.

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, *43*(2–3), 172–194. https://doi.org/10.1016/j.lrp.2009.07.003

Thomä, J. (2017). DUI mode learning and barriers to innovation—A case from Germany. *Research Policy*, *46*(7), 1327–1339. https://doi.org/10.1016/J.RESPOL.2017.06.004

Tong, C., Tak, W. I. W., & Wong, A. (2015). The Impact of Knowledge Sharing on the Relationship between Organizational culture and Job Satisfaction: The Perception of Information Communication and Technology (ICT) Practitioners in Hong Kong. *International Journal of Human Resource Studies*, *5*(1), 19. https://doi.org/10.5296/ijhrs.v5i1.6895

Tucci, C. L., Chesbrough, H., Piller, F., & West, J. (2016). When do firms undertake open, collaborative activities? Introduction to the special section on open innovation and open business models. *Industrial and Corporate Change*, *25*(2), 283–288. https://doi.org/10.1093/icc/dtw002

Valdez-Juárez, L. E., De Lema, D. G. P., & Maldonado-Guzmán, G. (2016). Management of knowledge, innovation and performance in SMEs. *Interdisciplinary Journal of Information, Knowledge, and Management*, *11*(April 2018), 141–176. https://doi.org/10.28945/3455

Van Riel, A. C. R., Henseler, J., Kemény, I., & Sasovova, Z. (2017).

Estimating hierarchical constructs using consistent partial least squares. *Industrial Management & Data Systems*, *117*(3), 459–477. https://doi.org/10.1108/IMDS-07-2016-0286

Vandenberg, R. J., & Lance, C. E. (2000a). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, *3*(1), 4–70. https://doi.org/10.1177/109442810031002

Vandenberg, R. J., & Lance, C. E. (2000b). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, *3*(1), 4–70. https://doi.org/10.1177/109442810031002

Wetzels, M., Odekerken-Schröder, G., & van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and Empirical Illustration. *MIS Quarterly*, *33*(1), 177–195. https://doi.org/Article

Zahra, S. a, & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, *27*(2), 185–203. https://doi.org/10.2307/4134351

Zhu, Y., Wittmann, X., & Peng, M. W. (2012). Institution-based barriers to innovation in SMEs in China. *Asia Pacific Journal of Management*, *29*(4), 1131–1142. https://doi.org/10.1007/s10490-011-9263-7

Conflict of Interest

"The authors declare no conflict of interest." or delete this entire section

Notes/Thanks/Other declarations

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